CLAIMS

What is claimed is:

1. A magnetic head, comprising:

a free layer;

an antiferromagnetic layer spaced apart from the free layer; and

an antiparallel (AP) pinned layer structure positioned between the free layer and the antiferromagnetic layer and having a net magnetic moment equal to about zero;

wherein the AP pinned layer structure includes antiparallel pinned layers that are pinned through large magnetic anisotropy due to positive magnetostriction and small net moment for the antiparallel pinned layers;

wherein the antiferromagnetic layer provides a coercivity that enhances pinning of the AP pinned layer structure.

2. A head as recited in claim 1, wherein the antiferromagnetic layer provides a coercivity of at least about 300 Oe.

3. A head as recited in claim 1, wherein the antiferromagnetic layer provides a coercivity of at least about 400 Oe.

4. A head as recited in claim 1, wherein the antiferromagnetic layer is constructed of PtMn having a thickness of between about 50 Å and 100 Å.

5. A head as recited in claim 1, wherein the antiferromagnetic layer is constructed of PtMn having a thickness of between about 60 Å and 90 Å.

6. A head as recited in claim 5, wherein the antiferromagnetic layer provides a coercivity of at least about 400 Oe.

7. A head as recited in claim 1, wherein the antiferromagnetic layer has a high positive magnetostriction.

8. A head as recited in claim 1, wherein the AP pinned layer structure includes at least two pinned layers having magnetic moments that are self-pinned antiparallel to each other, the pinned layers being separated by an AP coupling layer.

9. A head as recited in claim 8, wherein a thickness of the AP coupling layer and thicknesses of the pinned layers are selected to provide a pinned layer saturation field of at least 5 KOe.

10. A head as recited in claim 8, wherein the magnetic anisotropy of the AP pinned layer structure is oriented perpendicular to an ABS of the reading head.

11. A head as recited in claim 1, wherein the head is adapted to read from media having a bit density of at least about 200 Gbit/in^2.

12. A head as recited in claim 1, further comprising an in-stack bias layer, the bias layer stabilizing the free layer, the AP pinned layer structure stabilizing the in-stack bias layer.

13. A head as recited in claim 1, further comprising a bias layer formed along a track edge of the head, the bias layer stabilizing the free layer.

14. A head as recited in claim 1, wherein the head forms part of a GMR head.

15. A head as recited in claim 1, wherein the head forms part of a CPP GMR sensor.

16. A head as recited in claim 1, wherein the head forms part of a CIP GMR sensor.

17. A head as recited in claim 1, wherein the head forms part of a tunnel valve sensor.

18. A magnetic head, comprising:

a free layer;

an antiferromagnetic layer spaced apart from the free layer, the antiferromagnetic layer being constructed of PtMn having a thickness of between about 50 Å and 100 Å; and

an antiparallel (AP) pinned layer structure positioned between the free layer and the antiferromagnetic layer, wherein the AP pinned layer structure includes at least two pinned layers having magnetic moments that are self-pinned antiparallel to each other through large magnetic anisotropy due to positive magnetostriction and a small net moment for the antiparallel pinned layers, the pinned layers being separated by an AP coupling layer;

wherein the antiferromagnetic layer provides a coercivity that enhances pinning of the AP pinned layer structure.

19. A head as recited in claim 18, wherein the antiferromagnetic layer provides a coercivity of at least about 300 Oe.

20. A head as recited in claim 18, wherein the antiferromagnetic layer provides a coercivity of at least about 400 Oe.

21. A head as recited in claim 18, wherein the antiferromagnetic layer is constructed of PtMn having a thickness of between about 60 Å and 90 Å.

22. A head as recited in claim 18, wherein the antiferromagnetic layer has a high positive magnetostriction.

23. A head as recited in claim 18, wherein the pinned layers are constructed of at least CoFe and the AP coupling layer is constructed of at least Ru.

24. A head as recited in claim 18, wherein a thickness of the AP coupling layer and thicknesses of the pinned layers are selected to provide a pinned layer saturation field of at least 5 KOe.

25. A head as recited in claim 18, wherein the magnetic anisotropy of the AP pinned layer structure is oriented perpendicular to an ABS of the reading head.

26. A head as recited in claim 18, wherein the head is adapted to read from media having a bit density of at least about 200 $Gbit/in^2$.

27. A head as recited in claim 18, further comprising an in-stack bias layer, the bias layer stabilizing the free layer, the AP pinned layer structure stabilizing the in-stack bias layer.

28. A head as recited in claim 18, further comprising a bias layer formed along a track edge of the head, the bias layer stabilizing the free layer.

29. A head as recited in claim 18, wherein the head forms part of a GMR head.

30. A head as recited in claim 18, wherein the head forms part of a CPP GMR sensor.

31. A head as recited in claim 18, wherein the head forms part of a CIP GMR sensor.

32. A head as recited in claim 18, wherein the head forms part of a tunnel valve sensor.

33. A magnetic storage system, comprising:
magnetic media;
at least one head for reading from and writing to the magnetic media, each head having:
a sensor having the structure recited in claim 1;
a write element coupled to the sensor;
a slider for supporting the head; and
a control unit coupled to the head for controlling operation of the head.

34. A magnetic storage system, comprising:
magnetic media;
at least one head for reading from and writing to the magnetic media, each head having:
a sensor having the structure recited in claim 18;
a write element coupled to the sensor;
a slider for supporting the head; and
a control unit coupled to the head for controlling operation of the head.